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THE

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AND OF

THE INSTITUTIONS IN UNION.

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Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MAY 31.—*Derby Day.*—NO MEETING.

JUNE 7.—*Extra Meeting.*—"On the Policy of an Amalgamation of the Railways of the United Kingdom, under Government Management." By WILLIAM HAWES, Esq., Chairman of the Council.

CONVERSAZIONE.

The Council have arranged for a Conversazione on Wednesday, the 14th June, at the South Kensington Museum, cards for which will shortly be issued.

INTERNATIONAL EXHIBITION OF 1862.—JURY REPORTS.

The Council beg leave to announce that there are a small number of copies remaining of these Reports, which may now be had on application at the Society's House, price £1 5s. in cloth, or £1 11s. 6d. bound in morocco.

Proceedings of the Society.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 24th, 1865; W. Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Hawkins, Henry, Wallingford, Berkshire.
Holroyd, Edward, Church-street, Wimbledon, S.W.
Miller, James Gordon, Financial Insurance Company, 60, King William-street, E.C.
Payne, Wyndham, 32, Kensington-square, W.
Smith, Thomas Roger, 57, Strand, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Homan, Julius, 85, The Grove, Camberwell, S.
Hunt, Alfred Terrett, 1, Encombe-terrace, Wandsworth-road, S.W.

The Secretary called attention to a peculiar kind of slow-burning fuel, described at page 469.

The Paper read was—

ANCHORS AND CABLES; THEIR HISTORY, VARIETIES, AND PROPERTIES.

By THOMAS MURRAY GLADSTONE, C.E., Asso. I.N.A., Engineer to Lloyd's Registry of British and Foreign Shipping.

The ground tackle of ships is a subject of no mean importance, and comes next to the construction of the hull itself. It has had the attentive consideration of the nautical man as well as of the scientific inquirer throughout all ages of history, its improvements commencing with the first dawn of civilisation. When we trace the history of anchors and cables, we can observe the clear advance of human intelligence, and we also cannot fail to find traces therefrom of a retrograde nature among mankind at different epochs. These form certain strongly-divided landmarks, which are made to appear in the course of this investigation. If we take the records of the Chinese, we are given to understand that in the earliest period of their history, from the trading character of their people, anchors and cables (it is true of a primitive character) were known. Though their records can hardly be exactly ascertained as to their approximate dates, yet they show, most decidedly, the antiquity of the use of ground tackle by a people, whole villages of whom live upon the water. Whether the anchors were wood, loaded with stone, or wood, bound together by some metal and weighted, of the crudest form; whether the cables were most rudely put together with the fibres of grasses, or however uncouth and peculiar, they formed the first step in human progression towards the means of navigation. On the other hand we have historical records, both as regards anchors and cables, in the more western world, upon which great reliance can be placed; and as the subject naturally divides itself into two parts, that of the anchor and the cable, as a matter of precedence I *will* commence by a brief historical account of the *anchor.*

The anchor being of such vast importance in navigation, from its complicated and weighty character, the want of it must have occasioned the utmost obstruction to the navigator, for it became a necessity on mankind venturing, after constructing larger vessels than canoes, to extend navigation to the coasts. They then found it imperatively needful to have some means that would give security to their ships, when exposed to either a lee-shore or to strong currents. The most ancient consisted of large stones, sacks filled with sand, or logs of wood loaded with lead, the last of which may even now be seen as used by the Chinese in securing their unwieldy junks. Of this kind was the anchor of the ancient Greeks, which, according to the accounts given by Polonius Rhodius, and Stephen of Byzantium, was made of stone; Athenæus states that they were sometimes made of wood and loaded with stone. It was found that, as these only retained the vessel by their friction on the bottom of the sea combined with their inertia, other contrivances became necessary for the purpose; therefore, as early as iron could be made available, it was introduced for their construction, and then began the grand improvements in forming them with teeth or flukes, by which to fasten themselves in the ground. Thus the words *οδοντες* and *dentes* are frequently applied to anchors by the Greek and Latin poets; but the general term used by the Greeks for anchor is *αγκυρα*, which Vassius thinks is derived from *αγκη*, a hook or crook, an instrument of iron used for holding ships in any situation, by preventing them drifting on to the shore or rocks; this being effected when the anchor is let down from the ship and fixes itself in the ground so as to hold the vessel fast. The invention of the teeth is ascribed by Pliny to the Tuscans, but Pausanias gives the merit to Midas, King of Phrygia. Originally there was only one fluke or tooth, but, shortly after, a second was added, according to Pliny, by Eupalarius, or, according to Strabo, by Anacharsis, the Scythian philosopher. The anchors with two teeth were called *αμφιβολοι*, and from ancient monuments they appear not to be dissimilar to the old Admiralty anchor as used until a very recent period of modern history.

It would appear, therefore, that anchors were generally made of iron through many ages; but in Spain, and in some other parts of the world, when that metal was not available, they were made of copper, and, in the South Seas, of a heavy wood, called "iron wood," from its great specific gravity. Anchors are mentioned in only two places in the Holy Scriptures. The first by St. Paul, when he and his companions were shipwrecked. On fearing they should be cast upon the rocks, "they cast four anchors out of the stern" (Acts xxvii., 30 v.), and in his Epistle to the Hebrews (vi., 19 v.) the same apostle, having no doubt a vivid recollection of his danger, uses it as an illustration when he says, "Which hope we have, as an anchor of the soul, both sure and steadfast." It would appear that, even at this time, vessels had numerous anchors, the largest of which corresponded with what is now denominated the "best bower," or "sheet anchor." This was never used but in extreme danger, and hence was peculiarly termed *ιερα*, or "sacra;" thence the expression "Sacra anchora," as indicating the last refuge. Indeed at this time, for want of a proper instrument, such as I proposed in a paper given in the volume for 1863 of the Transactions of the Society of Naval Architects, along with the drawing which would enable us to know what strain a ship exerts upon her ground tackle in all weathers, we have not attached to every vessel that "sacra anchora" so justly venerated by the ancients.

As the sizes of vessels increased, and the working of iron in large masses was still difficult, it can be readily imagined how costly the anchor must have been; so that through many ages that which is so commonly used in moderate-sized ships of the present day, and so economically manufactured, would have been worth its weight in silver; indeed, would have been thought one of the wonders of the world.

The modern improvements are exemplified in the numerous drawings now before the meeting. The first which connects the ancient with the modern times is the old Admiralty anchor, contrasting which with the new Admiralty anchor, it will be seen what a decided improvement and increased beauty of form is reached. Besides these we have a great variety of anchors, the designs of many inventors. When I note that upwards of 80 patents have been taken out for anchors within the last century, it gives strong evidence that a large amount of ingenuity has been exerted towards attempting to perfect this valuable instrument. Among these I will give a few illustrations from those that best deserve consideration, including those which from their intrinsic merits have become, and are generally used, at this day.

These useful anchors divide themselves into three distinct kinds, each having its peculiar merits, and each having its supporters among nautical men. The first is that which I have alluded to, the "Admiralty anchor," which includes, as a class, all anchors with a "solid cross" or "crown," that is, Mr. Perring's improved Admiralty anchor, Captain Rodger's, Captain Hall's portable anchor, Mr. Cotsell's improved admiralty, Mr. Hutchin's, and other solid crowned anchors. The second is the "pivot" anchor, beginning with Mr. Porter's—Mr. Trotman's, and Mr. Wood's, being of the same class and based upon the same principles. The third is that of Captain Hawkins, of which Mr. Martin's is shown in a great degree to be a modification.

Of the first class it is reasoned, that being of a solid form throughout and less complicated in workmanship, it is, whether as the Admiralty or as Rodgers's anchor, the most reliable for general use. But it is evident that, under one circumstance at least, it has this disadvantage, that as in shallow water the upper fluke of the anchor points upwards from the ground, the vessel is liable to be injured by the anchor piercing her bottom. It will easily be seen that in the anchors of the No. 2 and No. 3 class this liability does not exist. On the other hand it is given as an argument against these other forms of anchors, that in the parts which are jointed they are likely to become fixed by stones or other material of the ground, so as to prevent the arms from taking the proper direction for holding the ship.

Another disadvantage of pivot anchors was said to be that when the ship veered from the direct line of strain in which the anchor lay, it had a tendency to destruction from the arm slipping from off the shank, but this weakness is obviated completely in Mr. Wood's anchor by an indent on the shank, making such liability impossible. It is seen that Capt. Hawkins' and Mr. Martin's anchors hold by both arms, and not as the others, by one only. It would appear that these give all which an anchor requires, yet it has been asserted that these are not perfect, and their holding power not certain when the ship swerves from the straight line, being apt to trip. If these opinions be correct, the perfect anchor has not yet been produced; there is, therefore, a field for inventors to work in not yet exhausted. But it is a satisfaction to note that so great has been the attention and care in the proportions and manufacture of anchors, that a very high condition of security is given in the use of these several valuable descriptions.

To ascertain one great necessity in anchors—that is strength—some test becomes necessary, so as to secure the full results of these qualities according to their character and design. This test is by tensile strain, the mode of applying which I will describe further on.

The following table gives the tensile strain of the three most distinguished anchors, and sets forth their extreme value:—

ON THE RELATIVE POWERS OF THREE KINDS OF ANCHORS AS TESTED BY A SPECIAL COMMITTEE IN 1851.

	cwt.	qr.	lb.	Admiralty Proof. Tons.	Cracked at Tons.	Broke at Tons.
Admiralty ...	20	2	0	... $21\frac{15}{20}$	... 48	... $56\frac{10}{20}$
Rodgers	19	0	8	... $19\frac{10}{20}$	... 45	... $73\frac{10}{20}$
Trotman's ...	21	1	10	... $21\frac{17}{20}$	... $51\frac{10}{20}$	... $53\frac{5}{20}$

Showing Rodgers up to final separation $270\frac{1}{3}$ per cent. beyond Admiralty test; Trotman's ditto, $143\frac{3}{4}$ ditto; Admiralty ditto, 160 ditto; although Trotman's exceeds the others up to the point of an appearance of weakness.

I now proceed to examine the other branch of this interesting subject, namely—cables. This can be distinctly separated into two parts, the one class being made from fibrous and vegetable substances, the other being made of metal. For a given period, up to the commencement of the present century, the former was the sole substance of which the cable was made. This was chiefly the direction in which Russian hemp was largely consumed, as, from the smallest line of the thickness of a quill to the largest cable, sometimes even 26 inches in circumference, it was used; but, like all vegetable substances, it was subject to decay. Coir rope also began to be used. Tar was employed to help its preservation, yet its duration was very limited; besides, it was readily chafed by harder matter, so that it became a constant employment for the seamen to save the rope by gaskins, whether at its attachment to the anchor, the pressure at the hawspipe, at the windlass, or elsewhere, which abrasion added not a little to the cost of maintenance with relation to the general charge of the ship. For warping, and for other purposes where comparative lightness is desirable, ropes composed of these substances are still in use, but the disadvantages of rope in the form of a cable for holding the ship were found to be very great; its great bulk, its rapid deterioration from the action of damp, its liability, in despite of every precaution, to be abraded on rocky ground, its certainty of being cut in a tideway by the action of ice, and its greater cost compared with the iron cable, even at extravagant prices—these were more than equal to the advantages arising from its greater elasticity and lightness, so that, for 30 years past, rope cables have been quite superseded by those made of iron.

When first I considered this subject with relation to the second part, that is "iron cables," I believed these to be an invention within my own lifetime, but on looking into the Patent-office, I found that in 1606 there was a patent taken out for chains, the terms of which were very quaint, but practically clear. I thought this was going a great way back, but searching further I found, from an old manuscript in the British Museum (a most valuable and highly illuminated work), that in the 14th century chains were used on board ship instead of hemp. Nor can the fact be questioned, as in a drawing in the same M.S. the ships are moored to the beach by chains, the links themselves being shown. But searching still further—in Cæsar's account of his Gallic wars, about 57 years before the Christian era, these remarkable observations are made by that conqueror, when writing of the Veneti of Brittany. "These people," he says, "trading with the Ancient Britons, called Belgæ, (who inhabited that portion of England which would include Somersetshire, Cornwall, Devon, and all the south-west of England and Wales) used cables made of iron instead of rope." Now, this singular fact, emanating from so old and excellent an authority, suggests many reflections as to what must have been the condition of the iron manufacture here, and shows it to have been one of the early productions of Great Britain. It points out that nearly 2,000 years ago, in addition to copper, tin, lead, and other metals for which the Phœnicians and other eastern nations traded with Great Britain, the most intrinsically valuable of all of these metals, iron, must have constituted an important item of the industry of the people, and almost makes us think that there must have been a considerable amount of practical mechanical knowledge diffused among the people. The term barbarian must, therefore, be taken in a very modified sense when used by their invaders and conquerors, the Romans, on being applied to the people of Great Britain.

Iron cables were re-introduced early in the present century, and in 1808 Lieutenant Brown, afterwards Admiral, became actively engaged in developing the use and advantages to be derived from them. At the same time, if not earlier, Mr. Robt. Flinn, of North Shields, seems to have been promoting their manufacture, and the following advertisement given in the *Newcastle Courant* of that year, proves his enterprising spirit:—"Notice to Ship-owners. Robt. Flinn, black and whitesmith, North Shields, respectfully acquaints shipowners and the public that at this period, when hemp can scarcely be procured, he manufactures chain hawsers for ships, of any length or size. The ship *Ann and Isabella*, Mr. Donkin owner, was the first to make trial of a chain hawser, when it was found to answer exceedingly well, both as a bower in Shields harbour, and as a mooring junk in the Pool." My informant also remembers hearing the story that in this year, when the ice cut all the ships in Shields harbour adrift, the *Ann and Isabella*, being moored with a chain hawser, was the only one that rode in the stream safely, so that after that a great demand sprung up for chain hawsers or cables.

According to the account of Mrs. Fawcus, the daughter of Mr. Flinn, Lieutenant Brown got the idea from her father for making cables and hawsers of chain, and on his trying to prevent Mr. Flinn from making chain cables and hawsers, the issue proved that the latter had made them before the former.

It is curious to observe the prices which prevailed on this introduction of iron cables, being no less than 74s. 8d. per cwt., when better proportioned chains of the best material are obtained at this time at 15s. per cwt., or one-fifth of the former cost.

The scarcity of hemp which is noted in the above advertisement was occasioned by that great attempt made by Napoleon I. and the Emperor Alexander of Russia, by a compact between them to exclude all the products of the Continent from entering into Great Britain, the products of Great Britain to be also excluded from the continent of Europe. But this could not be permanent, and was of short duration, though tried by these two mighty autocrats, while even such an attempt at the subversion of the free interchange of commodities, no doubt contributed to the introduction of chain cables by increasing the price of hemp, and thereby stimulated our iron industry, the manufacture of iron being at a low ebb in this country at this time, both in quantity and quality. As proof of this, even within my recollection it was considered necessary to use foreign iron to a considerable extent in the manufacture of anchors, from the indifferent quality of English iron. For any iron work that required great manipulation foreign iron was almost solely used. As an illustration of the backwardness of that now most prominent and important production of native industry, it was subsequently to the year 1820 that even hoops were made of English iron. Previously the iron was imported for this purpose from Sweden or Russia in bars, and converted into hoop iron at several water mills situate on the tributaries to the River Thames.

Such being the difficulties, the early manufacturers of chain cables must either have had the iron specially made for them, which is most likely, or their manufacture of chains must have been very inferior and not dissimilar to many that have been manufactured of late years, the last so indifferent as to have demanded legislation thereon.

It appears that the ordinary chains first made were close links, but shortly patents were taken out for twisted and stud links. The twisted link soon passed away, and the short and stud link remain to the present time as the two conditions in the manufacture of iron cables. The action of the stud was to prevent the collapsing of the sides of the links, to which a chain has a tendency at extreme pressures; therefore, the stud link is commonly used for cables. The ultimate actual strength of the two is found to nearly assimilate, and I am almost inclined to doubt whether the short link should not be preferred for cables, seeing that if, by any extraordinary pressure, any portion of the links should be found to have become rigid from their collapse, the chain would be considered unfit for future use, while in the stud link, although it might have been subjected to an undue strain, no such deterioration could be detected.

Contrasted with ropes, the chain has many advantages. By its weight it aids its holding powers; by its weight it compensates for its want of elasticity; by its weight it assists as ballast, and its want of bulk affords increased

LLOYD'S TABLE, No. 22.—MINIMUM WEIGHTS (EX. STOCK) OF ANCHORS OF UNOBJECTIONABLE FORM AND PROPORTIONS; SIZES AND LENGTHS OF CHAIN CABLES; AND THE PROOF STRAIN TO WHICH THEY ARE TO BE TESTED; AND THE SIZES AND LENGTHS OF HAWSERS AND WARPS.

SHIP'S TONNAGE.	ANCHORS.								STUD-CHAIN CABLES.†			HAWSERS AND WARPS.					SHIP'S TONNAGE.
	Number.			Weight.					Minimum Size.	Proved to Admiralty Test.	Length.	Stream.		Hawser.	Warp.	Length.	
				Bowers.*		Including Stock.											
	Bowers.	Stream.	Kedges.	Ex. Stock.	Admiralty Test.	Stream.	Kedge.	Second Kedge.				Chain.	Rope.				
tons.				cwts.	tons.	cwts.	cwts.	cwts.	inch.‡	tons.	fathoms.		inch.	inch.	inch.		tons.
50	2	1	1	$2\frac{1}{4}$	$4\frac{7}{10}$	1	$\frac{1}{2}$	...	$\frac{11}{16}$	$8\frac{1}{2}$	120	$\frac{7}{16}$	5	3	...	The length of them to be 90 fathoms each.	50
75	2	1	1	$2\frac{3}{4}$	$5\frac{2}{10}$	$1\frac{1}{2}$	$\frac{3}{4}$	...	$\frac{12}{16}$	$10\frac{1}{10}$	120	$\frac{7}{16}$	5	3	...		75
100	2	1	1	4	$6\frac{4}{10}$	$1\frac{3}{4}$	1	...	$\frac{13}{16}$	$11\frac{9}{10}$	150	$\frac{8}{16}$	$5\frac{1}{2}$	3	...		100
125	2	1	1	$5\frac{1}{4}$	$7\frac{6}{10}$	2	1	...	$\frac{14}{16}$	$13\frac{3}{4}$	180	$\frac{8}{16}$	$5\frac{1}{2}$	$3\frac{1}{2}$	...		125
150	2	1	1	6	$8\frac{2}{10}$	$2\frac{1}{2}$	$1\frac{1}{4}$	...	$\frac{15}{16}$	$15\frac{3}{4}$	180	$\frac{9}{16}$	6	4	...		150
175	2	1	1	$7\frac{1}{4}$	$9\frac{5}{10}$	$2\frac{3}{4}$	$1\frac{1}{4}$	...	1	18	180	$\frac{9}{16}$	6	4	...		175
200	3	1	1	$8\frac{1}{4}$	$10\frac{4}{10}$	3	$1\frac{1}{2}$	...	$1\frac{1}{16}$	$20\frac{3}{10}$	180	$\frac{10}{16}$	$6\frac{1}{2}$	4	...		200
250	3	1	2	10	12	$4\frac{3}{4}$	$2\frac{1}{4}$	1	$1\frac{2}{16}$	$22\frac{3}{4}$	210	$\frac{10}{16}$	7	5	...		250
300	3	1	2	12	$13\frac{9}{10}$	5	$2\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{16}$	$25\frac{1}{2}$	210	$\frac{11}{16}$	$7\frac{1}{2}$	$5\frac{1}{2}$	...		300
350	3	1	2	$13\frac{1}{2}$	$15\frac{2}{10}$	6	3	$1\frac{1}{2}$	$1\frac{4}{16}$	$28\frac{1}{10}$	240	$\frac{11}{16}$	$7\frac{1}{2}$	$5\frac{1}{2}$	...		350
400	3	1	2	$15\frac{1}{4}$	$16\frac{7}{10}$	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{5}{16}$	31	240	$\frac{12}{16}$	8	6	...		400
450	3	1	2	$16\frac{3}{4}$	18	7	$3\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{6}{16}$	34	270	$\frac{12}{16}$	$8\frac{1}{2}$	$6\frac{1}{2}$	...		450
500	3	1	2	18	19	8	4	2	$1\frac{7}{16}$	$37\frac{2}{10}$	270	$\frac{13}{16}$	9	7	...		500
600	3	1	2	21	$21\frac{6}{10}$	9	$4\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{8}{16}$	$40\frac{1}{2}$	270	$\frac{13}{16}$	$9\frac{1}{2}$	7	4		600
700	3	1	2	$23\frac{1}{2}$	$23\frac{5}{10}$	10	5	$2\frac{1}{2}$	$1\frac{9}{16}$	44	300	$\frac{14}{16}$	10	8	5		700
800	3	1	2	$25\frac{1}{2}$	$25\frac{2}{10}$	$10\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{3}{4}$	$1\frac{10}{16}$	$47\frac{1}{2}$	300	$\frac{14}{16}$	10	8	5		800
900	3	1	2	$27\frac{3}{4}$	$26\frac{9}{10}$	11	$5\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{11}{16}$	$51\frac{2}{10}$	300	$\frac{15}{16}$	10	9	$5\frac{1}{2}$		900
1,000	3	1	2	30	$28\frac{6}{10}$	12	6	3	$1\frac{12}{16}$	$55\frac{1}{10}$	300	$\frac{15}{16}$	10	9	$5\frac{1}{2}$		1,000
1,200	3	1	2	32	$30\frac{1}{10}$	13	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{13}{16}$	$59\frac{1}{10}$	300	1	10	$9\frac{1}{2}$	6		1,200
1,400	3	1	2	34	$31\frac{6}{10}$	$13\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{1}{4}$	$1\frac{14}{16}$	$63\frac{1}{4}$	300	1	10	10	6		1,400
1,600	3	1	2	$36\frac{1}{2}$	$33\frac{4}{10}$	14	7	$3\frac{1}{2}$	$1\frac{15}{16}$	$67\frac{1}{2}$	300	$1\frac{1}{16}$	11	$10\frac{1}{2}$	$6\frac{1}{2}$		1,600
1,800	3	1	2	38	$34\frac{5}{10}$	$14\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{1}{2}$	2	72	300	$1\frac{1}{16}$	11	11	7		1,800
2,000	4	1	2	40	$35\frac{7}{10}$	15	$7\frac{1}{2}$	$3\frac{3}{4}$	$2\frac{1}{16}$	$76\frac{1}{2}$	300	$1\frac{2}{16}$	11	11	7		2,000
2,500	4	1	2	42	$37\frac{1}{10}$	17	$8\frac{1}{2}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$81\frac{3}{10}$	330	$1\frac{2}{16}$	12	12	8		2,500
3,000	4	1	2	45	$39\frac{2}{10}$	19	$9\frac{1}{2}$	$4\frac{3}{4}$	$2\frac{1}{4}$	$91\frac{1}{10}$	360	$1\frac{3}{16}$	12	12	8		3,000

MEM.—For Steamers the Anchors and Cables will not be required to exceed in weight and length those of a sailing vessel of two-thirds their tonnage.

* Two of the Bower Anchors must not be less than the weight set forth above, but in the third a reduction of 15 per cent. will be allowed. All Anchor Stocks must be of acknowledged and approved description.

† Unstudded close-link Chains of one inch in diameter and under, will be admitted as Cables, if proved to two-thirds the Test required or Stud-Chains; but in all such cases a short length, not less than twelve links, must be tested up to the full strain for Stud-link Chains.

‡ Persons desirous of using or supplying Chains of a smaller size, and who are willing to submit them to a greater strain than set forth above, may submit their propositions to the Committee.

space on board ship. Its durability is also great, and, with care and proper usage, it will exceed the life-time of any ship.

From the great improvements that have taken place in the manufacture of iron, from the increased skill of the workmen, and from the great attention which experience has tended to give to its manufacture, we have reached a condition with regard to chain cables, when made in the best way, which is all that can be desired, and the proportion of Lloyd's table No. 22 I think affords a very large amount of security for life and property on shipboard, if all these points are attended to.

As quality, however, is of every importance, both in the anchor and the cable, it was found necessary to legislate thereon, in consequence of bad manufacture (cheapness, not quality) ruling; and last year Mr. Laird, the member for Birkenhead, carried his Bill for the "Testing of Chain Cables and Anchors," which Bill comes into effect on the 1st of July next. This is a step in the right direction, while already Lloyd's Committee of Registry had determined not to give the Class A 1 to any vessel whose cables and anchors had not been tested at a public machine approved by them, and also in sizes, lengths, and proportions, in accordance with their table No. 22. Independent, therefore, of public legislation, besides the public machines at Liverpool, by the activity of Lloyd's Committee, there have been established and are being constructed more than a dozen public testing machines in different parts of the country, and all that are completed are doing excellent service. The scale adopted for the test is that known as the Admiralty scale of proof, and Lloyd's rule is that all cables and anchors must pass such test in a satisfactory manner. As it is necessary to have proper machinery for passing this ordeal, several modes have been adopted for putting on the necessary strain, either by compound wheels, the worm and wheel, or by hydraulic force. From its simplicity, reduced friction, and economic character, the hydraulic power prevails. This power, so valuable for heavy pressures, and so reliable and controllable, has become one of the most important assistants to the engineer, so much so that without it many works of the present day could never have been accomplished.

I recollect, in the year 1850, when standing on the top of one of the tubes of the railway bridge at Conway, North Wales, the weight of which was somewhere about 600 tons, in conversation with the late lamented Mr. Robert Stephenson and Capt. Moorsom, and when the tube was being lifted equally at both ends at the speed of three feet in one hour by this marvellous hydraulic force, it was remarked—how wonderful, how true, and how controllable was the hydraulic press, and how exactly to be measured by the graduated steel yard.

At any time, with a note from your excellent secretary or other officer of the Society of Arts, I should be happy to show to any of the members the operations at Lloyd's testing-house, Poplar, as the proving of anchors and chain cables proceeds daily at that establishment, and has done so for the last two years and a half under my superintendence; the simplicity, exactness, and rapidity with which the process is carried on would, I think, be fully apparent, and, indeed, to the scientific inquirer, would be found to be exceedingly interesting.

As my time is limited, I have thought it better not to enter into further details in one paper, but I shall hope to have the opportunity for doing so on some future occasion, when many material points can be examined which I have not now ventured to touch upon.

In conclusion I append Lloyd's table No. 22, containing the Nos. and weights of anchors for vessels from 50 to 3,000 tons, also the sizes, tests, lengths of chain cables, hawsers, and warps required, the compliance with which is necessary to give the shipowner the A 1 class for his vessel.

DISCUSSION.

Mr. F. A. Paget said, having given some attention to at least one branch of Mr. Gladstone's subject, perhaps he might be allowed to make a few observations. Mr. Gladstone had alluded to an instrument, proposed by him, for measuring the strain on chain cables. Having carefully examined his plan, he (Mr. Paget) regretted to state that it was defective in every respect. This was the case quite apart from any difficulties as to the application of the proposed instrument. In the first place, it was unprovided with any means for allowing for the friction of its two leather packings. But even disregarding this shortcoming, it lacked the most important requirement of any common dynamometer. What was demanded in an instrument of this kind, was—according to known principles—in this special case, a record of the work done on the cable by the surge of the vessel. Such a dynamometer ought to be able to record at once the force, the motion, and therefore the work. Mr. Gladstone's proposed instrument no more indicated this than was the work done by a steam engine recorded by the steam gauge. What was required was, in fact, the use of an instrument similar in principle to the ordinary steam engine indicator. A band of paper ought to be moved at right angles to the direction of the pull on the cable, and with a velocity of a known constant proportion. This could, in fact, be done by applying an indicator on Bourdon's principle, and leaving the marks of its pencil on a card worked either by the operator, or by means of wheel work, or even in some cases by the sea. Adapted to a cylinder with a piston pressing on a volume of water enclosed in an elastic diaphragm, it was probable that such an instrument would lead to very useful deductions. Mr. Perkins had, it was stated, used very successfully an indicator of this kind, made by M. Bourdon. There was another point on which he regretted to differ from Mr. Gladstone. He had spoken of the exactness with which the process of testing chain cables was carried on at his establishment. The Board of Trade did him (Mr. Paget) the honour, yesterday, while again requesting him to report on the whole question, to communicate that Mr. Gladstone had now adopted levers and dead weight to his machine, and also that he now no longer preferred to test chains and anchors after being blacked. Mr. Gladstone, however, still appeared to think that it was correct to test 75 fathoms at a time. Admitting that there was a difference in the stress at different parts of the length, Mr. Gladstone thought that all irregularity was obviated by the use of the rollers fixed underneath the cable. But he would ask him whether the roller which would touch and thus support a 2¼-inch chain, would also do this for an inch chain? With respect to the supposed proofs Mr. Gladstone had adduced to support his views, it was to be observed that the resistance of iron varied so much that it was only by means of averages, deduced from a very great number of experiments, that the influence of the weight of the cable itself on the test would be apparent. It was an universally acknowledged fact, that any deduction of the kind could only be formed upon a very great number of data. Kinks were also more easily formed in long lengths, and Mr. Gladstone had himself confessed to a case in which "a link pressed crossways against one of the rollers."

Mr. Green deprecated the introduction into the discussion of matters not within the scope of the paper, a course which, he said, had been taken by the gentleman who had just sat down.

The Chairman said it might, perhaps, be doubtful whether the subject referred to by Mr. Paget was strictly within the scope of the discussion, but he always thought it better to allow a certain latitude.

Mr. Paget submitted that his remarks applied to two distinct subjects introduced in the paper, viz., the principle of testing chain cables, and the special machinery employed by Mr. Gladstone for that operation.

Mr. Robert Davison thought the objection made to the remarks of Mr. Paget a very proper one, a passing allusion only having been made in the paper to the testing machine employed by Mr. Gladstone. He had seen that machine in operation, and was fully satisfied with its working. He was at a loss to know on what grounds opinions so adverse to that machine could be formed.

Mr. Rochussen regretted that the subject of the materials of which anchors and cables were formed had not received a more extended notice in Mr. Gladstone's paper. In ship-building it was well known that steel was gradually making way, and it would, no doubt, also be ultimately used for anchors, if not for chain cables, from its greater tensile strength than iron. The standing objection at present against the use of steel was its expense, and the enhanced cost of workmanship as compared with iron, particularly in cases where great accuracy of fitting was required. This, however, was not the case with anchors, which could, therefore, be produced in steel at a comparatively moderate rate. The application of cast steel to the manufacture of chain cables was practically impossible, owing to its unweldable properties, and, therefore, they must fall back upon soft puddled steel. It was a fact much to be regretted that the English workman appeared to have a great aversion to the manipulation of steel. It was therefore to be expected that he would interpose all the difficulties he could in the way of welding the modifications of steel which modern science had introduced into our manufactures. The puddled steel to which he alluded was proved to possess a tensile strength double that of iron. Taking the price of iron for these purposes at £8 per ton, steel of the same dimensions could be obtained at from £15 to £16 per ton; adding to that the cost of workmanship, taking into account a little loss at first, they might have steel anchors and cables at about £25 per ton. That being the case, looking to the important functions that were performed by anchors and cables, he put it to the meeting whether we were justified in using a material for these purposes which would bear a tensile strain of only twenty tons to the square inch, when there was another material at hand which was capable of sustaining a tensile strain of forty tons to the square inch; and while railway travellers were protected, in being drawn up inclined planes, by a material equal to a strain of 60 to 65 tons to the square inch, the lives of our seamen were only guarded by a material the resistance of which rarely exceeded twenty tons to the square inch. He believed shipowners, as a rule, were satisfied if they received from the builder a vessel and its fittings which barely fulfilled the conditions of the class which it represented, and he feared unless the public took up this question of anchors and cables for themselves, that neither under Lloyd's rules nor any other regulations would they have the largest amount of protection that could be afforded in maritime communication.

Mr. **LENOX** said that in a paper which he read before the Institute of Naval Architects* he had given the history of chain cable manufacture as nearly as possible as it now stood, and he endeavoured to point out the reasons why chain cables, generally speaking, were most disreputable productions. A little liberality and encouragement on the part of the shipowner were required in order to place this branch of production upon the same scale of excellence as other manufactures in this country. With regard to anchors it was pretty well known that they had been a subject of investigation by a great number of ingenious gentlemen, who each imagined that their own form of anchor was the best; but for his own part he believed that no great advance had been made in this direction since the introduction of what was known as the Admiralty anchor. He gathered from the paper that Mr. Gladstone regarded the Trotman anchor as carrying off the palm from all others. [Mr. **GLADSTONE** said he only enumerated that anchor amongst others.] The table given by Mr. Gladstone showed the results of the well-known Anchor Committee of the Government, but knowing as he did the manner in which their trials were conducted, he had no confidence in the results they arrived at. Mr. Lenox entered into a somewhat lengthened history with regard to various forms of anchors from the year 1820, tracing the subject up to the period of the introduction of the Admiralty anchor, the merits of which he claimed for the firm with which he was connected. Up to that period, he submitted, the anchors in use, both in the navy and mercantile marine, were not of a reliable character, either in form or manufacture. They were originally confided by the Government to contractors, who, in some cases, made them so badly that there was scarcely any union between the arms and the shank. These anchors lasted as long as the elastic material, hemp, was employed for cables, but with chain cables they were found to be all but useless. He had known a ship go out with eight or nine of these anchors, and on her return, after three years, she had scarcely a sound one left. A quantity of those anchors were handed over to him by the Government to be altered, and, if possible, made serviceable. Those which were moderately sound, after he took them in hand, stood the proof, but wherever there was a flaw in the crown, which was the most important part of an anchor, the expense of the alteration was greater than it was worth while to incur. Mr. Lenox passed on to remark upon the anchor known as Rodgers', which, he said, appeared very soon after the introduction of the Admiralty anchor. The trials of the model of this anchor made at the Exhibition of 1851 were, in his opinion, most fallacious. For his own part, he liked the first form of the Rodgers' anchor better than the second, and the second better than the third, although it was asserted that the last was capable of standing any proof that could reasonably be applied to it. He would ask where was the use of having anchors four or five times as strong as the chain cable that was to be attached to them? They wanted an anchor only a little stronger than the cable, and he therefore agreed with Mr. Gladstone that the field was still open for further improvements in this direction. Mr. Lenox then adverted to the difficulties which were experienced in the manufacture both of anchors and chain cables until testing machinery was introduced. The machine for that purpose on his own premises, he said, was the joint production of Mr. Rennie (father of Sir John Rennie) and Mr. Walker, a talented machinist who acted as his foreman, and that machine he had in use at the present time. It had been employed in the testing of iron of all kinds. The character of that machine was such that the Board of Trade had decided to license it for testing under the provisions of the late Act of Parliament. He submitted that Lloyd's proving apparatus had yet to receive this sanction; whether they would have the good judgment to make it answer the requirements of the Act of Parliament he could not say. He concluded by remarking, that as long as he remained a manufacturer of anchors and cables it would always be his earnest desire to furnish that which could be thoroughly relied upon.

Mr. **TROTMAN** vindicated the claims of his form of anchor. It had, he said, been approved by an independent committee appointed by the Admiralty to test its merits, and upon its merits he was content to let it stand or fall. He was ready at any time to meet the Committee of Lloyd's with facts, and he challenged the investigation of the scientific world on the subject of his anchor.

Mr. C. F. T. **YOUNG** remarked that notwithstanding the condemnation which had been passed by Mr. Lenox upon Trotman's anchor, he understood that gentleman was at the present time making a number of them for the Admiralty; and it was a curious fact that if those anchors were so bad the Queen's yacht was provided with them. With regard to the Martin and Hawkins' anchors, they appeared to be very much of the type of a hundred years back. On the subject of testing he would say he believed there were grave objections to Lloyd's machine, and that it gave fallacious results. He considered that the safety of our marine demanded the most stringent rules on the subject of the testing of anchors and chain cables.

Capt. **RODGERS**, R.N., said with regard to the experiments with his anchor at the Exhibition of 1851, they must speak for themselves. Mr. Lenox should have stated the weights respectively of the models experimented upon. The model of the Admiralty anchor weighed 24 lbs., including the stock, while that of his own anchor weighed only 18 lbs., also including the stock, and that difference of 6 lbs., put into cwts., amounted to something considerable. He had devoted a long life to the study of anchors, theoretically and practically, and his first patent was dated in 1819. He admitted that was a total failure. He had now reached his seventh, and he hoped his last patent. He scarcely knew anything which was really so little understood as an anchor. He had rarely met a man who did understand the principle of the anchor, and it was only after fifteen years unremitting study of the subject that he believed he understood it himself, and even now he was not quite sure he did so. He had lately ascertained that three manufacturers in the north, who were licensed for his patent, had made no fewer than 12,200 of his anchors in the last three years. Having detailed the experiments made with his kedge and bower anchors in competition with the Admiralty pattern, Capt. Rodgers, in conclusion, remarked that he had hoped to have heard a criticism upon the properties of the different forms of anchor rather than a history of their introduction.

Mr. **THOMAS GRAY** said, Mr. Gladstone had evidently given this subject great consideration, and had written a very clear paper upon it, for which he personally felt much indebted to him. The discussion, however, had somewhat diverged from the original purpose of the paper. Mr. Lenox had favoured them with a chronological history of patent anchors from the earliest times. He had also explained clearly the various alterations effected from time to time in the Admiralty anchor, of which, in its present form, he thought so highly; and had then gone on to show that his testing machinery was, in his own opinion, better than others. It was on this subject that he (Mr. Gray) wished to say a few words. Mr. Paget had to-night taken exception to the testing in lengths of 75 fathoms, which seemed to be the capacity of the machine at Poplar, designed (as both Mr. Gladstone and Mr. Dunn had informed him) by Mr. Gladstone himself, manufactured by Mr. Thos. Dunn, of Manchester, and now known as Lloyd's testing machine at Poplar. Now he would say that that machine was almost universally condemned by anchor and cable makers in the country; and that was the machine they were invited to inspect as a model for the simplicity, exactness, and rapidity with which the work was executed. The peculiar claims alleged in behalf of this machine were that it tested in 75 fathoms lengths instead of 15 fathoms, that it did the work in less time than other machines, and did it better. But, unfortunately (if it did so), anchor and cable makers generally had no confidence in it; whether they were right or wrong in this it was not for him (Mr. Gray) to say. In the testing of 75 fathoms length Mr. Gladstone's rule was that the tensile strain itself with the tapping of the hammer was a sufficient testing. [Mr. Gladstone—No, no.] If he were wrong he would rely on Mr. Gladstone to set him right. At all events, the main testing was by tensile strain alone. The test insisted on at Birkenhead and at other public machines of reputation was a tensile strain applied to 15 fathoms lengths, and a subsequent searching examination of each link by two pairs of eyes. The testing strain was applied at Birkenhead before the chain was "blacked," whereas Mr. Gladstone tested "blacked" chains. This was objectionable, as the heat evolved by the strain might cause, and in many cases did cause, the blacking to fill up a flaw in the iron and render it imperceptible. In the next place the machine at Poplar relied mainly upon its hydraulic cylinder, and connected with that cylinder there was a plunger which communicated with a graduated lever for indicating the pressure in the cylinder; but it had been held by the most competent authorities, and could not be controverted, that that was not a correct method of indicating the strain put upon the chain; whether it indicated the exact pressure in the cylinder was indeed an open question. What he most congratulated Mr. Gladstone on this evening was, that he had to some extent apparently seen the error of his ways, by having the lever apparatus added to his machine, so as to put it as nearly as possible on a par with Mr. Lenox's machine, the chief difference being, that Mr. Gladstone's tested in 75 fathoms lengths and Mr. Lenox's in only 15 fathoms. Mr. Gladstone having come over so far, might, he hoped, go yet further, and, when he saw the necessity for it, would probably reduce his machine to 15 fathoms. He hoped that should he have the gratification of hearing Mr. Gladstone read his next paper, after making further alterations in his proving house, he should have the pleasure of agreeing with him, instead of—as he now had the pain of—differing from him.

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* Trans. Inst. Naval Architects, Vol. i., p. 160.

Mr. Gladstone, in reply upon the discussion, said he could assure the meeting it gave him great satisfaction that he had had an opportunity of listening to the opinions of various gentlemen on this subject, so that if he was wrong he might be set right. He did not, however, admit that he was wrong, and, as his views had been shown to be correct by disinterested engineers of high standing, he must hope that he should have the gratification of hearing from Mr. Gray next time they met a confession of the error of his ways, and an admission that he (Mr. Gladstone) was right. He quite understood the point that was raised by Mr. Paget's opening remarks, viz., that he had seen reason not to trust to the hydraulic machine as a sure indicator of power. He confessed he had heard Mr. Gray's criticism of the machine in question with some amazement, for though it was true that gentleman and Mr. Galloway came to see the machine at Poplar, they neither took any account of the dimensions of the parts, nor carefully ascertained its operation; and the plunger—that was a small piston—spoken of by Mr. Gray, was not on the top of the hydraulic cylinder at all, but many feet removed from it. It had been stated that this was a machine of his (Mr. Gladstone's) own designing, but it was made by Mr. Dunn, whose plans he approved of as Lloyd's engineer, and it was his office to see that the work was done well; he pointed out, however, what he thought would be an improvement, viz., the extending the test from 15 fathoms to a greater distance. Differences of opinion seemed to have recently arisen as to this machine, judging by a report sent to the Board of Trade, "that the ordinary mode of measuring by the hydraulic lever is liable to great variations from circumstances entirely beyond the control of the person working the machine, therefore not to be relied upon." The machine was represented as being inaccurate; it was also stated that the process and principle that he adopted was wrong, viz., that instead of being confined to testing fifteen fathoms, which had never been exceeded up to that time, at Lloyd's machine they were enabled to prove all intermediate lengths up to seventy-five fathoms, and the following curious statement was made that, when a 15 fathoms length was tested the chain was stretched perfectly tight like a string on a violin, but in the 75 fathoms length the chain was never pulled out of the form of a curve, or rather a series of curves or festoons. It was still more curious, that those who made this report should never have measured the deflection *in a single 15* fathoms of chain when under test alone, and also measured the deflection when more lengths than one 15 fathoms were under test, as, had they done so, they would have found no difference whatever between any one of the 15 fathoms at the Admiralty proof. In order to prove that the extended length could be equally well used, at Lloyd's machine there were placed powerful levers, with knife edges, constructed by the eminent firm of Messrs. Maudslay, Sons, and Field, in such a manner as to apply them either at 15 fathoms lengths, or at the more extended lengths, when they were found to coincide with the hydraulic lever in both situations simultaneously. When several lengths of large chain were at the Admiralty test, the deflections between each fifteen fathoms were carefully measured by Mr. Field and Mr. Crosland, and they were found all equal, each deflection being 1½ inch only, or 3 in 2,160 inches; therefore, how it was conceived that they hung in a series of curves or festoons he could not possibly imagine. Certain other experiments were made which proved most completely that whether at fifteen, thirty, forty-five, sixty, or seventy-five fathoms, the strain was perfectly equal throughout the whole, therefore the plan adopted by him for Lloyd's Committee proved itself to be correct in principle and practice, while its economy was obvious, since by the ordinary mode of testing for the complement of a single ship's chains, viz., 300 fathoms, it took twenty proofs, while at Lloyd's machine it took but four or five, and as it only took two or three minutes to put seventy-five fathoms of the largest chain in the machine, and two or three minutes to place it on the examining bench by such contrivances as he had invented and applied, it would be obvious how greatly increased must be the economy and despatch in the operation. He should regret indeed, therefore, if any obstruction were thrown in the way of that which had been decided by disinterested parties to be a great improvement. Mr. Lenox had stated that his machine was worked by hydraulic power at one end and by lever power at the other, but Mr. Lenox had no means of measuring the proportionate exactness of his levers. Lloyd's Committee declared they were satisfied with the test of their machine, and they said if it was not satisfactory to the public, let three eminent practical men, like Sir W. Armstrong, Mr. Fairbairn, and Mr. Penn, investigate the question, and declare whether he (Mr. Gladstone) was right or wrong in the principle he contended for. Mr. Davison, who had experimented on this machine, stated that there was no differential variation whatever at any of the distances. Mr. Lenox had complained that he (Mr. Gladstone) had omitted to mention a great many other anchors that had appeared. If he had mentioned all he would have had to include a list of at least eighty patents. He considered the remarks of Mr. Lenox as to swivels in chains very valuable. In his paper he had given a brief notice of the leading forms of anchor, without comment of his own, leaving each form to stand upon its own merits. He had been much interested by the discussion, and he trusted that on a future occasion he should be allowed the opportunity of extending this interesting and important inquiry.

The Chairman said he had now to ask the meeting to express its thanks to Mr. Gladstone for the interesting paper he had read. They must all admit this subject to be of great importance, and one to which a society of this kind could never regret having devoted an evening. The practical object doubtless was to get a good anchor and a good chain cable; but he apprehended that achievement would not be promoted either by patents or by Government patronage, for most of the observations they had heard that evening tended to show that nothing that had yet been done in this direction had been influenced by the privileges conferred by the patent laws or by the patronage of the Government. After all, the most efficient means of obtaining the best thing was to trust to competition among the manufacturers of the country, the stimulus of which would induce them to bring the utmost amount of science and skill to bear on this important branch of manufacture. There was also a further question, whether, considering the vast amount of private property at stake, it was desirable for the Government to interfere to require a proper testing of these cables and anchors. What had been the result of the step taken so far? An act was passed within the last twelve months requiring that all anchors and cables should be tested, and now they found those most interested in the question disputing as to the reliability of the testing machines employed. When the Government system of testing was in full operation, would they be much nearer in arriving at the best anchor than they were now, by going to those whose manufacture had proved to be the best? They had much better rely upon themselves, and the more they threw upon individuals interested the responsibility of providing the best machinery for carrying such works into effect, the better it would be for all parties. In the paper the fact was mentioned that during the great war Napoleon threw such difficulties in the way of our obtaining hemp for our cables that we were compelled to seek for a substitute in the shape of iron. He (the chairman) could not but contrast that period and the conduct of the First Napoleon, with the present period and the conduct of the Third Napoleon—a man who was doing all he could to bring into friendly rivalry the manufacturers of both countries, and in every way to promote commercial intercourse between the two nations, a course of policy which, considering the objects which this Society was established to promote, could not fail to enlist our cordial sympathy. He now begged to propose a vote of thanks to Mr. Gladstone for his excellent paper.

The vote of thanks was then passed and acknowledged·

Proceedings of Institutions.

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Manchester Mechanics' Institution.—In their Forty-first Annual Report the directors congratulate the members upon being able to present an encouraging statement of the past year's proceedings. . The fears expressed at the commencement of the year, that the commercial depression under which the district was suffering would continue to affect the attendance in the classes, has happily been only partially realised; the number of pupils connected with the various departments in 1864, in most instances comparing favourably with the number attending in 1863. The attendance at the boys' day classes has been satisfactory, showing a slight increase, with a corresponding improvement in the receipts. An examination of the students was held by one of H.M. Inspectors of Schools. At the Government Science Examinations, the candidates from these classes have more than sustained the reputation of the school, and have been awarded two silver medals and a large number of prizes. The attendance averages over 200. Nine candidates were successful in the Oxford Middle-Class Examinations. The attendance at the ladies' day classes is not so good as it was in 1863. In 1861 the number of pupils attending was 242. In 1862 the attendance fell to 229, in 1863 to 201, and in 1864 to 181. These classes have also been examined by the Inspector of Schools. The attendance in these classes, which averaged over 200 in 1863, fell to 180 in 1864. The female evening classes have been well attended. The number of pupils in the summer months was limited, but during the winter quarters the attendance has been so large as to render it necessary to remove the class to a more commodious room in the Institution. The number of pupils on the books in the December quarter was 53. In the evening classes for young men there has been a considerable increase in the attendance, which averaged about 300. Mr. David Baxter has continued his gratuitous services as the teacher of the bookkeeping class. The great success of his pupils at the Society of Arts Examination, is evidence of the ability and zeal with which the class has been conducted. In the Government science classes the number of students who have entered compares favourably with that of the preceding year; but, considering the importance of the subjects taught, the attendance must be deemed far from satisfactory. In the examinations of the Department, however, this Institution has been successful beyond any other. Three silver medals, four bronze medals, and more than one hundred prizes, were awarded, while several students secured "Honourable Mention." The results of the Society of Arts Examination have already been published. Mr. H. J. Leppoc for the second time placed at the disposal of the directors a prize of five pounds, to be divided equally among those students who should most distinguish themselves in arithmetic at these examinations. The annual vacation party of the day classes was held in June, and the usual soirée of the dancing class was held at the close of the year. The gymnastic club still continues one of the most popular features of the Institution. The skill displayed by the members at the last assault-at-arms clearly proved that the club still maintains its high state of efficiency. A challenge gold medal has been offered for competition by Mr. G. T. Lund, in addition to a silver and a bronze medal presented by the committee and the members. The billiard club has been eminently successful during the first year of its existence. It has in a very large degree promoted social and friendly intercourse amongst those who were unable to avail themselves of the other advantages offered in the Institution. The circulation of books from the library has decreased from 32,579 in 1863, to 27,411 in 1864. The directors record with deep regret the death of the chairman of the board, Mr. J. W. Edge, who for very many years had enjoyed the confidence and esteem of the members, as well as of Mr. John Heywood, vice-president. The directors congratulate the members upon the financial position of the Institution. At the commencement of the year there was a balance in hand of £679 7s. 2d., with unpaid accounts amounting to £187 15s. 5d. There is a balance of £998 3s. 4d., with unpaid accounts amounting to £171 9s. The income has amounted to £3,037 6s. 8d. The total number of members is 1,531, against 1,307 in the previous year.

ANGLO-FRENCH WORKING CLASS EXHIBITION.

A meeting of working men was held in the Society's great room (by permission of the Council), convened by the promoters of the above undertaking, on Tuesday evening, the 23rd inst., William Hawes, Esq., Chairman oft he Council, in the chair.

The **CHAIRMAN**, in opening the meeting, said that the Council, upon receiving a communication from Mr. Coningsby, the secretary to the committee formed for carrying out this proposed Exhibition, stating what steps had already been taken in this movement, and the success of the preliminary measures both in England and in France, were desirous that the Society should offer every encouragement to the undertaking. For his own part, he (the chairman) felt especial pleasure in presiding over what he might almost call the first meeting which had been held in this metropolis for the purpose of uniting the English and the French workman in friendly rivalry, the object being not so much to prove that the one was superior to the other in any particular branch of art or of manufacture, but to give them an opportunity of showing each other that in which each excelled, so that the workmen of both countries might learn in what direction they should apply their time and talents, so as to produce the most beneficial results to themselves, and the countries in which they respectively lived. It was quite clear that both England and France, from the great intelligence, perseverance, and industry of their people, must necessarily be constantly rivals; but it was of the utmost importance that their rivalry should be a rivalry of friendship, and not a rivalry arising from feelings of distrust or national prejudice. He could imagine nothing better calculated to produce a friendly rivalry likely to benefit both countries than this proposed Exhibition. This was a year, certainly, in which such an exhibition might be very appropriately organised, being the fiftieth year of peace between the two countries. That fact in itself was a remarkable evidence of how great a length of time was required to remove prejudice when once it was deeply seated between nations. It appeared to have taken fifty years before the working men of both countries, who formed the great mass of the population, could meet upon terms of peace and good fellowship, and enter into friendly competition with each other. However glad we might be that such a result was brought about at last, we could not help feeling what a melancholy instance this was of the great mischief which followed long and devastating wars, and the great amount of prejudice and ill-feeling which were thus engendered to the great detriment of the world at large, and more especially of those countries where such wars were carried on. Now, however, that these fifty years had passed, we could not but hope that the good feeling between the two countries would increase year by year, stimulated as it was by the enlightened men of this country, as well as by that great man who was now the ruler of the French people. It was remarkable how much had been accomplished by that illustrious sovereign, whose acts had so materially aided the progress of free-trade in Europe. Without that encouragement, which happily the Emperor had not only the will but the courage to give to free-trade and free communication, he (the chairman) really believed the progress which had been made would not only not have been accomplished, but would even now have scarcely been begun. During the Bourbon dynasty there appeared to be little chance for such free communication between England and France as there now was, for he was sure they must all feel that the abolition of passports and the interchange of commodities now carried on under the French treaty were remarkable proofs of the truly enlightened spirit in which the French Emperor regarded questions of international commercial policy, and he had little doubt that the undertaking which they had now met to consider would receive every encouragement from the French Government. He would now call on Mr. Coningsby to explain the steps that had already been taken in connection with this movement. After that some resolutions would be proposed in order to promote the success of the undertaking.

Mr. R. **CONINGSBY** said he would begin by stating that they did not, however anxious the committee might be to secure the support of all present, now come to ask if this thing should be done, but only how it should best be done. They were too far committed to it to retrace their steps. The origin of the scheme was something like this. A few friends and himself went to the Agricultural Hall last October, when the North London Exhibition was being held there, with the view of carefully examining the exhibition, so as to see what representation it was of the best productions of the working-classes. Without wishing to depreciate that Exhibition, he must frankly say they could not regard it as a fair representation of what the working classes really could do, and feeling this, they took counsel together whether something could not be done that would give to the section of the working classes not represented there an opportunity of coming forward and showing what they could produce. A committee was formed of about 40, all of whom were working men. There were no patrons, and at first it was decided to have none, that anybody who liked might help the movement, but that the Committee would not solicit patronage. They thought their first step should be to find what amount of assistance they could expect from their own countrymen. Many of the committee-men were foremen in large establishments, and these men talked both with their shop-fellows and employers as to what countenance they would give them. This was done before they committed themselves to the scheme at all, and before calling any public meeting. From inquiries made it appeared that the scheme was likely to take, and the committee had many promises of help, both from workmen themselves and their masters. Those of the members who had friends in provincial towns wrote to them, and found that they received the matter in a very favourable manner. It then came to be a question whether this should be a local movement, or whether they should invite competition from a larger area. It was decided that there was no great use in circumscribing the affair, and, as this year was the fiftieth anniversary of peace between England and France, they thought of making it a jubilee movement, and inviting the French workmen over to compete with them. It was rather a difficult matter to find out whether the French would enter into it or not. The English were ready enough, but they felt some diffidence in going to France as the representatives of English working men. It seemed something like the three tailors of Tooley-street being the representatives of the British people, and they were therefore careful in stating to the French that they merely represented their own committee. Five of them were requested to go to Paris. Their own committee subscribed all the necessary funds, and asked nobody for a penny. They went to Paris, and took a few letters of introduction with them. The idea had been well received here, but when they got to Paris they found that it was received with enthusiasm. Every person they called upon—no matter what his position—whether workman, senator, or manufacturer, gave them the same warm welcome. He was sure every member of the deputation would bear him out when he said that it was quite a mistake to suppose that there was any coldness on the part of the working classes of France towards this country; they had the warmest feelings for us, and he thought that if this matter had stopped here, and had gone no farther, it would be worth all the trouble they had taken to ascertain this one great fact—that there is no ill-feeling or prejudice existing in the minds of our social equals in France towards the workmen of England. They were taken up by a society called the "Société du Crédit au Travail." He believed there was nothing like this society in this country; it was a sort of bank, into which every member put 100 francs, which was laid out in the purchase of land. It was a very responsible organisation, and the deputation were recommended to it by M. Michel Chevalier. This society called a meeting of delegates, representing all the principal associations in Paris, to the number of about eighty. They put a great many questions to the deputation; they did not want to go into the matter at hap-hazard, but wished to know the grounds of success. They were told frankly what had been done from the very commencement, and given distinctly to understand that they were not there as representing the English workmen, but only their own committee. The meeting passed resolutions approving of the scheme, and, on the spot, appointed a committee of ten gentlemen, well known in connection with the Crédit Foncier and other important organisations, and many of them being also chairmen of large co-operative associations. That committee promised to send a circular to each of the departments, and, as three of them were editors of newspapers, they promised to use their influence through the press, and gave every prospect of a wide co-operation on the part of the French people. The deputation called on about five-and-twenty manufacturers, to whom they had letters of introduction, and found that to a man they were all ready to send their goods to the Exhibition. The Crystal Palace had a great name in Paris: people there believed in it, and as soon as they heard that their visitors came from the Crystal Palace they were quite ready to send their goods. M. Edmond Potonié was appointed as the secretary of the French committee, and favourable notices of the movement had been given by the French papers. The French Committee reported that they believed they would be able to send over a large amount of goods, and they were in a position to do this because they had large manufactories there, conducted on principles similar to those of our co-operative institutions in this country—extensive factories, from which a large quantity of goods for exhibition might be expected. The next step they were about to take was to send one of their number to Paris, to watch the interests of the affair, and to communicate between the two committees. The steps they had taken since their return to England might be soon summed up. The Society of Arts, through its Council, had taken up the movement with very great kindness. They had lent them this room for their meeting here, and the Chairman of the Council had been good enough to preside. Their object now was to lay their scheme before the meeting for their approval and assistance, which would be highly valued.

Mr. Whiteing proposed the following resolution:—

> "That this meeting, having heard the statement of Mr. Coningsby, in reference to the proposed Anglo-French Exhibition, recognizes in this movement an evidence of the gradual extinction of national prejudices, and of the great advance which has been made by the workmen of both countries in the knowledge and appreciation of the true principles on which the material prosperity and moral progress of nations depend."

He said that one object they had in calling the present meeting was to ask assistance in one department of the proposed Exhibition, namely, that of Art-workmanship. There could be no doubt that in the working men's exhibitions which had already taken place in London art-workmen had not been fairly represented, and it was very important that they should be in the present one.

Mr. Willis seconded the resolution.

Mr. Lucraft was sorry that he could not support the scheme, not that he did not approve of it, but only because he thought there would not be time to get up the Exhibition in such a manner as fairly to represent the British workman, who would thus be placed in an unfair position. He suggested that the Exhibition should be put off till next year, and that then not only French workmen, but those in all the countries of the continent and of the world should be invited to take part in it.

Mr. Anson thought the proposed Exhibition was a step in the right direction, and that it would instruct British workmen, and prepare them for future competitions. He felt so deeply interested in the movement that, though not affluent, he should be glad to be responsible, in the case of failure, to meet the expenses to the extent of £5.

Mr. Ashe and Mr. Buck highly approved of the scheme, and the latter gentleman said he was sure there would be plenty of time before the Exhibition opened for British workmen to prepare articles for show.

Mr. Pearsall (Secretary of the London Mechanics' Institution) congratulated the meeting on the success of the movement as far as it had gone. He believed the Exhibition would form a new and desirable link between employers and workmen, if, as he believed they would be quite willing to do, the masters would exhibit work done in their establishments with the names of the workmen attached to it. English and French workmen had much to teach each other and to learn from each other, and the proposed Exhibition would be an excellent opportunity of bringing them together.

Mr. Winkworth strongly supported the principle affirmed in the resolution, and stated his belief, founded on his experience as an adjudicator in the Great Exhibitions of 1851 and 1862, and of the Paris Exhibition of 1855, that English workmen need not fear to enter into competition with those of France. The progress made by the English in the silk manufacture between the two exhibitions was such as to astonish even the French people themselves. He believed the time was fully come when such an exhibition as that now proposed should take place, and that it would be of benefit to both countries.

The resolution was then carried unanimously.

Mr. Lock moved—

> "That this meeting pledges itself to promote by every means in its power the success of the undertaking."

So much had been said in support of the movement that it required nothing to be added to it, but he would suggest to the Committee that they should use their utmost exertions amongst the employers of labour, who were in possession of most of the works produced during the last few years by Art-workmen, and who would, doubtless, be glad to aid in promoting the success of the scheme. It was also necessary, in order that the exhibition might be thoroughly successful, that there should be the fullest confidence in the persons selected as adjudicators of the prizes.

Mr. Maynard seconded the resolution, which was unanimously carried.

Mr. R. Coningsby moved a cordial vote of thanks to the Society of Arts and to the Chairman, which was carried by acclamation.

The Chairman said that it was undoubtedly one of the most important functions of the Society of Arts to encourage Art-workmen. Arts, Manufactures, and Commerce were based upon the skill of the workman, and he conceived, therefore, that they were only doing their duty in endeavouring to promote this movement. He had already given them his opinion of its importance, and he would now only tell them what he thought about its success. When Prince Albert attended a meeting in that room previously to the Exhibition of 1851, and some doubts were expressed as to its success, his answer was, "Gentlemen, you will succeed because you are determined to succeed;" and the same remark might be applied to the present undertaking. The promoters of this movement had shown so much determination, and had received so much encouragement both here and in France, that there seemed little doubt as to their success. The movement must be a combined one between masters and men; masters must be willing to show their workmen's work, so that the actual producers might have the credit, which had hitherto too often been kept from them. The great value of such exhibitions was the strong stimulus they gave to progress and the promotion of self-respect and honourable feeling amongst workmen. If the masters would not allow the men to exhibit fine specimens of work which they had executed, a great part of the use of the Exhibition would be lost, but he felt sure that the masters would unite in promoting this friendly rivalry between their workmen and those of France. It had been said that English workmen must be beaten in matters of taste by the French, but was taste the only thing that was required in work, and were there not other qualities of as great if not greater importance? It was a remarkable fact, that so astonished were the French themselves at the progress we had made between the two Exhibitions of 1851 and 1862, that they actually sent over a commission to see by what means we had so improved our art manufactures in the short space of eleven years. The French people had to learn to imitate the solidity and lasting character of our work, and we had to learn the taste and elegance of theirs, so that there was much to learn on both sides, as well as much to teach, and every opportunity of doing this was a benefit to both countries. In conclusion, he would say that they were quite welcome to the use of the Society's room for their meeting. Anything the Society could do to promote the success of the Exhibition would be done. He thanked them for the compliment paid to the Society and himself in the vote just passed.

Fine Arts.

THE DE MORNY COLLECTION.—The late duke was a liberal patron of art and artists, and his collection of pictures and other objects of art and curiosity is certainly one of the most remarkable that was ever brought together in a period of ten or twelve years. The sale is fixed to commence on the last day of the present month of May, and to conclude on the 12th of June, the first four days being devoted to objects *d'art* and curiosities. The private views take place on the 25th and two following days, and the public exhibitions on the 28th and 29th instant; and, as a large attendance of amateurs and virtuosi is expected, it will be well to give the readers of the *Journal* a general idea of the contents of the collection. M. de Morny was a great admirer, and considered to be a good judge, of the works of the German, Flemish, and French schools, but he seems to have had little taste for the great Italian masters or for sculpture. Amongst the old paintings of the German, Flemish, and Dutch schools there are:—Three pieces by Cuyp; an excellent little work by Gerard Dow; one of Hobbema's finest works, known as Les Moulins, a glowing landscape—a river and mills, and five clumps of oaks, for which the late duke gave 100,000 francs; good specimens of Denner, Dusart, Erverdingen, Helst, Heyden, De Hoogh, and Huysmans; a very fine work by Maas, a robust servant girl ringing at a house door, with three children near; three remarkable pictures by Metzu; an admirable Miéris, the itinerant musician asleep in a cabin; three pictures by Ostade; a Paul Potter; one of the finest portraits extant by Rembrandt, a man in the prime of life, wearing a broad-brimmed hat, his face brillantly lighted up, known as Le Doreur, from the Chavagnac collection, as perfect as when it left the artist's hand, signed, and dated 1640; Europa, a small composition; and the portrait of an old woman, also by Rembrandt; Hercules and Omphale and a portrait by Rubens; three works by Ruysdaels; one by Jan Steen; two by Teniers; and three each by Ferburg, Van der Velde, and Wouvermans.—The elder French school includes, amongst other choice works, two fine pictures by Chardin; two of Fragonard's best known paintings; six by Greuze, including his famous Peasant Girl winding cotton; three of Prudhon's most admired works—Innocence, Cupid and Psyche, and Zephyr; and four good specimens of Watteau.—The contemporary French works include some very fine pictures, amongst which must be specially mentioned the Ape painting, by Decamps; six works by Meissonier, including two of his finest productions—The Bravos, 1852, and Halt of Cavaliers at the door of a country inn, 1863, which have never before been in the market; and four exquisite examples of his more usual style—a young man eating and reading; the amateur of drawings; a poet and a young man studying; and three charming works by Alphonse Rœhn, a French artist, who died last year, but whose works recal the best period of the Flemish school.—The Italian and Spanish schools are only represented by five works by Guardi, excellent specimens; two or three by Murillo; two of Salvator Rosa; and two Velasquez.—The collection of objects of art and curiosities consists almost entirely of Chinese and other oriental works in enamel, porcelain,, rock crystal, jade, and lacquer, many of which are very choice.

RAPHAEL'S FRESCOES.—A Parisian photographer has recently returned from Rome with twenty-seven plates of the frescoes of the Farnese Palace.

MONUMENT TO DANTE.—The inauguration of the monument raised in Florence in honour of the great poet of Italy, took place on the 14th May, with great ceremony, in the presence of King Victor Emmanuel. There was a grand procession, which occupied more than two hours in passing. First marched the representatives of the press (Italian and foreign); next came those of the Italian drama; then a long file of persons deputed from every province, town, academy, society, and important institution in the kingdom. Seven hundred banners floated in the air. The *cortége* was closed by the colleges, the national guard of Florence, in the ranks of which marched the Count Sarego Aligheri, descendant of the poet. The King was received with immense acclamations; upon his majesty's arrival the Gonfaloniere of Florence pronounced a short address, after which Padre Jean Baptiste Giulani delivered a discourse on Dante and and his works, at the conclusion of which the veil which until then had covered the monument fell to the ground. The entire arrangements proved satisfactory, and the enthusiasm is declared to have been indescribable. Such an act of national pride and fervour does honour to the capital of united Italy.

SALE OF ARTISTIC FURNITURE.—The sale of a remarkably fine collection of objects of Industrial Art took place recently in Paris. The articles disposed of belonged to the late Prince de Beauvau, and although consisting of but forty-four lots of furniture, bronzes, porcelain, and sundries, with seven pictures, the proceeds of the day's sale were £14,392. The most precious item in the former portion of the collection was a small secretaire of the time of Louis XVI., presented by Marie Antoinette to Madame Sénone, one of her ladies of honour, purchased for the Empress at £2,400. A commode, inlaid with marqueterie, and ornamented with chasings in bronze, by Gouthières, the cyphers of Marie Antoinette appearing amongst the ornaments, fetched £1,004. A console, in marqueterie, by a celebrated art-workman, I. H. Reisener, and bearing his signature, of the same period, sold for £828. Two small sofas, or settees for two persons each, fetched £400. A small ebony coffer, decorated with five Florentine mosaics, £118. An inlaid clockcase of the time of Louis XIV., £120. A small bureau of the time of Louis XIII., £122. A carved and gilt bedstead of the Louis XV. period, £162. A cup in Sicilian jasper, mounted in bronze, chased and gilt, by Gouthières, £1,276. Two candelabra, by the same artist, figures of Bacchantes, after Clodion, £644. An inkstand, attributed to the same artist, £232. Two candlesticks, ditto, £166. Pair of fire-dogs in bronze, chased and gilt, time of Louis XVI., £102. Six lots of porcelain fetched £1,872. A jewel-box in copper gilt, bearing the cyphers of Henry II. and Catherine de Medicis, £304; and two vases of porphyry, £644.

Manufactures.

NEW KIND OF FUEL.—A fuel has been invented by Mr. Stoker composed of carbon in powder as pure as possible, obtained from the distillation of light woods in a close receptacle of various metallic salts and acids acting as the combustible matter, and of different agglomerating bodies such as fecula, &c. The whole is triturated, mixed, and pressed, forming a paste, which may be moulded into cakes, balls, &c., of various sizes, to be afterwards dried. When dry this fuel may be lit by a lucifer match; it burns like a piece of tinder, and gives out neither smoke, gas, nor flame. The caloric disengaged in the burning of this fuel may be from 45° to 720° Fahrenheit, according to the proportion of the different component parts above cited. This fuel (says the inventor) will be found very useful for heating feet-warmers, for urns, dishes, and similar articles, for placing in plumber's soldering irons, or in irons for pressing linen; for heating glue in workshops or elsewhere where a fireplace would be inconvenient or dangerous, and for many other purposes.

New Gas for Motive Engines.—The Motor Lenoir has achieved considerable success, but its application is limited to the supply and cost of the gas required to work it, and it is said that an engineer of Lyons, M. Million, has hit upon an expedient which is likely to have a great effect in extending the use of that or other motors in which power is obtained by the explosion of mixed gases. The problem is to find a gaseous mixture which takes fire easily and rapidly, and which can be produced in almost any place at a low cost. This desideratum is believed to have been discovered in the gases which are given out when steam is made to pass over coke in a state of incandescence, or, in other words, in a mixture composed of oxide of carbon and carburetted hydrogen. The subject has been introduced in a lecture at the Sorbonne, and before the Scientific Association of Paris, by MM. Schlœsing and Demondésir, the engineers of the tobacco manufactory, and M. Troost, and has attracted considerable attention. In the experiments performed it was shown that when oxide of carbon alone was introduced into a vertical tube, and fired by a spark from a Ruhmkorf coil introduced at the upper end, a blue flame appeared and slowly traversed the tube until it reached the bottom, and that the introduction of a small quantity of hydrogen accelerated the combustion, and caused the flame to descend with greater rapidity. This was illustrated by a tube more than eighteen feet long. Another experiment showed that when the explosion was caused in a series of vertical tubes alternately connected together above and below, the flame when ascending traversed the tubes more quickly than when descending. The engineers mentioned are now carrying on a series of experiments to ascertain the most economical mixture of these gases with atmospheric air for motive purposes, and success is considered to be almost certain. It must not be forgotten, however, that although the new system may supply a cheaper and possibly more effective motive power, it will have one drawback that does not attach to the Lenoir motor, which can be used in workshops and other places where it would be impossible or inconvenient to introduce a furnace. As steam will be required to produce the gaseous mixture, the new motor will come into direct competition with the steam-engine, which the motor Lenoir does not.

Commerce.

French Trade with Abyssinia.—An expedition is announced to depart from Paris in the month of June, having for its object the establishing of a trade between the natives of Abyssinia and the French merchants in the Red Sea. The spot selected for the head-quarters of the expedition is Mount Taranta, which is not within the possessions of that dangerous monarch, King Theodore, and where the climate is described as being very temperate and healthy. The point of operations on the sea coast is to be Halaï, near Port Adulis. The funds are obtained by means of subscriptions from the persons engaged in the expedition, and it is said that the number already enrolled is sufficient to ensure the carrying out of the project. The projector and leader of the expedition is Count de Moynier, who is half an Englishman, his mother having been the daughter of General William Burn, whose services in India gained him the soubriquet of the Hero of Delhi. Count de Moynier announces in addition arrangements for affording sportsmen a chance of elephant and otter shooting in connection with the expedition, which will be armed and organized against any danger from the natives.

Colonies.

Arrowroot in New South Wales.—Experiments have recently been made on the root of the Cumbungah, a common reed, growing abundantly in the lagoons of the south-western districts, and possessing, it is believed, properties capable of affording employment to hundreds of persons. An excellent species of arrowroot has been made from this plant.

Docks in New South Wales.—The Fitzroy Dock, belonging to the Government, situate at the penal establishment of Cockatoo Island, is capable of taking in vessels of the largest tonnage. The Waterview Dock is very largely used in docking the vessels engaged in the mail services and those belonging to several local companies and proprietors, and is capable of taking in the largest class of ships. Adjoining are shipwright and engineering works, large shears for masting purposes, and every requisite for the repair of vessels in the several branches to which they apply. The floating dock in Darling Harbour is chiefly used in docking sailing vessels and small steamers. There is a very large establishment formed for making large power boilers and heavy machinery, provided with steam hammers for heavy forgings, large lathes, and all requisite tools for the construction or restoration of engines of large dimensions. The slip dock is capable of taking up separately two vessels of about 1,000 tons each. At these works four iron vessels have lately been built, adapted to the peculiar requirements of short river navigation, one of which was a gun boat built for the New Zealand Government, fitted with shot-proof towers, which has done good service and taken a very prominent part in the history of the present New Zealand war. The vessels are of large dimensions, to ensure a light draught of water.

Queensland Imports and Exports.—The total value of the imports for the year 1864 was £2,267,954, of which £1,746,841 came from Great Britain, £506,697 from the other Australian colonies, £7,370 from Germany, £6,880 from South America, £100 from the South Sea Islands, and £36 from New Caledonia. The total value of the exports for the year was £1,243,903, of which £354,437 were sent to Great Britain, £889,368 to the other Australian colonies, £632 to India, £7 to Ceylon, £24 to China, and £4 to South America. The comparison of these tables with those of former years shows the rapid progress the colony has made since 1860. If those who have been induced to settle there had not succeeded in obtaining profitable employment, they could not have afforded the luxuries which have been imported, and the total amount must have been greatly reduced as well as the average per head.

Rents of Crown Land in South Australia.—For many years the best pasture lands in the colony were leased at one farthing per acre yearly, until, in 1858, an Assessment on Stock Act was passed, making the payment for rent and taxes together one penny per acre yearly. This was, of course, still far below the value, and as in June of the present year, a large number of the leases expire, the lands comprised therein have been re-valued, and the average rent and assessment for the first batch of the best runs now amounts to about 6d. per acre per annum, which have been confirmed by the Government. Many farmers, however, are paying 1s. and 1s. 6d. per acre to private persons for grazing land.

Notes.

Cottagers' Exhibition at Amberley, Gloucestershire.—Some time ago the Rev. R. E. Blackwell, the incumbent of this parish, which has only 1,400 inhabitants, conceived the idea of finding some means by which poor people might be enabled usefully to amuse themselves in the winter evenings without having to leave their houses. The problem he wished to solve was how to find interesting and amusing occupation for the poor man at home during the winter months, and his idea was to get the poor to make whatever articles their taste or inclination prompted them to make, and which would yield them a return when they were sold at an exhibition that should take place at the winter's end. Last October, therefore, he issued a circular addressed to them, in which he said:—" My plan is to try and set all of you—men and women, boys and girls—to work in a pleasant way in your own houses, at your odd moments, during the winter, and for you to gain something by it. At some suitable time in the spring, I should like to have in our schoolroom an industrial exhibition. During the winter months I would have you all work for this, according to your own different tastes and powers; one making one thing, and one another. Everything you make will be your own. At the time fixed for the exhibition, I will endeavour to gather together our friends throughout the neighbourhood—and sell for you the things you have made, if you wish them to be sold. I do not promise to sell them, but I will try to do so. Let everybody make a something, however small or simple. Do not be shy, or hesitate to join our workers. Let every person in the parish be an exhibitor, and try and make something which will do him credit. Great moral benefits must result if we endeavour to spend our winter evenings in a profitable way." Mr. Blackwell suggested what kinds of thing could be made, and during the last six months nearly every cottage has been the nightly scene of work for this exhibition. Men, women, and children have been busy. There has been a curious reversion of labour; for weavers have done carpenters' work, and the industry of others has taken a direction equally strange. The articles made, together with others lent by ladies and gentlemen of the neighbourhood, were recently displayed in the schoolroom. Rugs and quilts, worked with every material and in every colour by the women and girls of the village, draped the walls. The articles of industry comprised vases, plates, and figures, sculptured in freestone; a model landscape; an obelisk in shell work; pencil drawings of cottages and gardens, done by boys; a shapely stone table, with ornamental pillar; a fancy oak table; a model church in stone; a spirit-level; a case of artificial flowers worked in wool; ingenious comic drawings; shoes, slippers, stockings, and other articles of dress. There was an ingenious rat-trap, for which a prize of £1 was given by the Ratcatching Club of London; a well-carved book-stand; a music-stand; and many other articles. The room has been crowded with visitors, and Mr. Blackwell was present to show the articles, most of which have been sold.

Correspondence.

On the Wear and Tear of Steam Boilers.—Sir,—I have seen Mr. Paget's double-barrelled letter in your last number, and observe there is a deal to be said on both sides of the question: but I shall confine my remarks within a very narrow compass. The essence of my first letter (in your number for May 12th) with respect to the furrowing of boiler-plates is, that Mr. Paget has adopted precisely the same view of the cause of furrowing that I did five years ago, namely, the action of the steam-pressure to straighten, or at all events to make more nearly straight than before, the common lap-joint, and thus to bring about an alternate bending and unbending of the metal, resulting in a loosening of the texture, and a greater susceptibility to corrosion. Now, I fail to find this central idea enunciated, or even hinted at, in the parallel column in Mr. Paget's letter. The only thing like it is in Mr. Braithwaite's paper, "On the Fatigue of Metals," where he refers to the buckling of locomotive smoke-box plates, in consequence of the strains from the cylinders, which are entirely exterior to the boiler. To this buckling action I alluded in my last letter. Mr. Renton, to whom Mr. Paget refers, does not in his pamphlet even hint at any explanation of furrowing action. With respect to the pitting of boiler-plates, I stated in "Recent Practice," that—

> "The pitting of the metal is readily explained by the presence of chemical agents in solution in the water, and the known inequality of substance of iron plates and bars, in consequence of which the metal is gradually but unequally separated and dissolved."

This, in like manner, is the essence of Mr. Paget's enlargements on the pitting of steam-boilers. In the same book, "Recent Practice" (pages 16, 17), I explained the causes of the failure of the stay-bolts of locomotive fire-boxes in the following terms, which I am obliged to quote for the benefit of Mr. Paget, who has vainly strived, he says, to find the explanation:—

> "Copper expands by heat half as much again as iron, and taking the mean temperature of the copper of the fire-box at twice as much as that of the shell, an assumption which, we suppose, is something much below the fact, the vertical expansion of the fire-box would be, upon the whole, three times as much as that of the shell, and the difference of expansion would be twice that of the iron, or at the rate of 1 in 500. On a fire box five feet three inches high, the difference of expansion would at this rate amount to one-eighth of an inch. That is to say, the upper stay-bolts would be deflected one-eighth of an inch from their normal position, when under the power of high-pressed steam. On a length of stay-bolt of three inches, a deflection of one-eighth of an inch is immoderate; and, considering the alternate expansion and contraction, bending and relaxing, attendant upon getting up steam and letting it down, it is reasonable to conclude that the same cause of degradation is at work with the stay-bolts as that already suggested for boiler-plates at the rivet-joints,—the alternation of strain, tension and relaxation, which loosens the texture, and ultimately overpowers the cohesion of the material so treated, incurring partial fracture and accelerated corrosion. On this argument the failure of stay-bolts should, as in fact it is, be localised at or near their junctions with the plates, which are the points of maximum strain, similarly to the localisation of furrows near rivet joints. Occasionally, entire rows of rivets are found to have snapped across, close to the plate, independently of corrosive action, suggesting a cause of failure precisely the same as that which breaks axles—an alternating lateral strain and relaxation beyond the limits of enduring elasticity."

* * * * * * *

> "The reasons above advanced afford an explanation of the fact that fire-boxes with narrow water spaces are more subject to leakage than those with wider spaces, the stays being shorter and less flexible in the former case, and likelier to fail. For the same reasons, stay-bolts of smaller diameter, sufficiently strong, are preferable to others of larger diameter. They are more elastic, and yield to unequal expansion more readily than thicker stays, and are, therefore, likely to be more durable."

In fine, Mr. Paget is quite welcome to the use of what I have before published; and, whether he acknowledges it or not, there is no doubt it forms the basis of the greater portion of his paper. Of course he has largely superadded illustrative and corroborative matter, which he appears to have expanded into what he calls the "bulging theory," whereby there is a disposition to convert a cylinder into a sphere. I believe I have said all that is necessary in explanation of my letter.—I am, &c.,

D. K. Clark.

11, Adam-street, Adelphi, May 22, 1865.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...British Architects, 8.
Asiatic, 3. Annual Meeting.
Tues. ...Civil Engineers, 9. President's Annual Conversazione.
R. Horticultural. Scientific meeting, 3 p.m. Mr. Bateman, "On *Cuitlanzinia pendula*, and a New African *Angræcum*, brought home by Capt. Grant."
Thurs...Antiquaries, 8.
Linnæan, 8. 1. Dr. Cobbold, "On Animal Individuality." 2. Dr. Baird, "Contributions towards a Monograph of the Annelides belonging to the *Aphroditaceæ*." 3. Mr. F. Walker, "Synopsis of the *Diptera* of the E. Archipelago."
Chemical, 8. Dr. W. A. Miller, "Analysis of Potable Waters."
R. Society Club, 6.
Fri.......Philological, 8.
Royal Institution, 8.
Archæological Inst., 4.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 13th and 15th May*, 1865.

256. Game Certificates (Ireland)—Return.
125. Bills—Drainage and Improvement of Lands Acts (Ireland) Amendment.
127. ,, Dogs Regulation (Ireland).
255. Newspapers and Stamps (Ireland)—Return.
258. Judgment Office (Ireland)—Returns.
261. St. Benet Gracechurch-street, &c., Benefices—Return.
264. Distillers, &c.—Return.
126. Bills—Arrests for Debt Abolition (Ireland).
128. ,, Turnpike Tolls Abolition.
129. ,, Customs and Inland Revenue.
130. Pier and Harbour Orders Confirmation.
131. Pilotage Order Confirmation (No. 2).
134. Forfeiture for Treason and Felony.
135. County Voters Registration (amended in Committee).
3. (305) Railway and Canal, &c., Bills—Board of Trade Report, Part 305.
234. Fethard Dispensary—Correspondence.
263. Dublin Corporation (Bills in Parliament)—Account.
132. Bills—Local Government Supplemental (No. 4).
134. ,, Forfeiture for Treason and Felony (a corrected copy).
138. ,, County of Sussex.
139. ,, Smoke Nuisance (Scotland) Acts Amendment.
140. ,, Ecclesiastical Leasing Act (1858) Amendment.
251. Civil Service—Report to the Lords of the Treasury in June, 1860.
269. Marines—Returns.
277. British Museum—Accounts.
136. Bills—Commissioners of Supply Meetings (Scotland) (as amended in Committee).
141. ,, Prisons (as amended by the Select Committee).
142. ,, Exchequer Bonds (£1,000,000).
143. ,, Locomotives on Roads (as amended in Committee, and on Consideration).
144. ,, Postmaster General.
215. Military Expenditure (Ceylon)—Despatch, &c.
260. Piccadilly and Park Lane New Road—Minutes of Evidence.
271. Merchant Seamen's Fund—Account.
272. Seamen's Savings Bank—Account.
274. Ramsgate Harbour—Statement.
178. Water Companies, &c.—Return.
3 (306). Railway and Canal, &c., Bills—Board of Trade Report Part 306.
Endowments for Education—Minute.

Delivered on 16th May, 1865.

137. Bills—Harwich Harbour.
146. ,, Crown Suits, &c.
235. Sugar, &c.—Tabular Return.
250. Savings Banks—Accounts.
250 (I). Savings Banks—Return.
270. Savings Banks—Account.

Delivered on 17th May, 1865.

147. Bill—Churches and Chapels Exemption (Scotland).
206. Cathedral and Collegiate Churches—Return.
257. Excise and Customs (Ireland)—Return.
266. Oaths and Declarations—Return.
282. Public House Closing Act (1864) Amendment Bill—Return.
Education (Science and Art)—Twelfth Report.
Education (Scotland)—Minute of further Suspension of Revised Code.

Session, 1864.

577 (I). Taxes in Europe—Return.

Patents.

From Commissioners of Patents Journal, May 19th.

Grants of Provisional Protection.

Alarms, self-acting, for indicating excess of heat or cold—1223—J. H. Johnson.
Buildings, construction of fire-proof—1170—J. Cunningham.
Candles, ornamenting—1299—P. Brash and R. Irvine.
Corn, &c., apparatus for grinding—1267—J. Hurt and H. Tonge.
Cotton and wool, presses for—846—W. Miller.
Cutlery, composition for cleaning, &c.—1054—G. Mountford.
Cylindrical castings, moulds for—1295—D. Hartley.
Cylindrical or conical articles, apparatus for cutting—1247—G. Redrup.
Decoctions, obtaining—1227—F. Wise.
Door mats—1283—T. J. Mayall.
Dredgers—828—W. Simons and A. Brown.
Extracting copper—1255—W. Henderson.
Fabrics, elastic knitted or looped—1275—R. B. Cooley.
Fibrous substances, apparatus used in carding—887—E. & F. A. Leigh.
Fire-arms, breech loading—1289—J. C. Conybeare.
Fire-arms, breech-loading—1293—P. O'Hagan.
Fire-grates, &c., supplying fuel to—1259—C. Lamport.
Fires, self-acting apparatus for extinguishing—1279—J. G. Hey and V. Savory.
Gases and vapours, method of mixing—1287—W. Jackson.
Grain, &c., self-acting and self-registering machinery for weighing—823—T. Roberts and L. Luc.
Illuminating purposes, apparatus for—1269—P. A. Le Comte de Fontainemoreau.
India rubber, treatment of—1257—T. J. Mayall.
Iron, apparatus for puddling—1221—T. F. Cashin & J. F. Alexander.
Jacquard and indexing machines—1261—J. Wadsworth, H. Dusset, and J. McMurdo.
Malt and grain, drying—1297—J. Forbes.
Metal, drilling and rivetting plates of—1291—D. Adamson.
Minerals, apparatus for working or cutting—1203—W. Leatham.
Motive power, machinery for obtaining—1301—W. J. Rice.
Motive power, obtaining and applying—1303—S. Pokutynski and M. Mycielski.
Pen, self-supplying—1231—J. Catillon.
Railway trains, communication between the passengers and guard of—1265—S. Trotman.
Refrigerator and condenser—1249—J. Hampton.
Saddles, safety stirrup for—1285—S. Hudson.
Ship compasses—1251—J. Lilley.
Ships, applying water as a motive power for—1053—G. Rosselet.
Ships, &c., construction and protection of—1209—G. Johnson.
Steam engines—1195—A. Wyllie and J. McF. Gray.
Steam engines, marine condensing—1253—T. Wood.
Tombstones, application of devices to—1130—A. Grainger and C. M. Girdler.
Topograph—84—A. F. Lendy.
Turkish towelling—1281—J. Gorton.
Window sashes and frames—1273—J. Casey.

Invention with Complete Specification Filed.

Flour mills—1348—H. A. Bonneville.

Patents Sealed.

2911. H. L. Maquet.
2912. J. Snider, jun.
2913. W. Ibotson.
2914. P. E. Gay.
2917. R. Morrison.
2920. G. M. de Bayelt and J. E. Vigoulete.
2923. F. Millns.
2924. S. Price.
2932. J. Kassack.
2933. J. Eastwood and W. Wadsworth.
2937. J. White.
2941. P. E. Gaiffe & E. Zglinicki.
2942. E. Cottam.
2948. L. Leisler.
2949. J. Grundy.
2951. C. Reeves.
2993. J. Soper.
272. T. Hall and S. Bonser.
333. W. P. Wilkins.

From Commissioners of Patents Journal, May 23rd.

Patents Sealed.

2956. J. Evans.
2959. L. A. W. Lund.
2962. W. E. Carrett, J. Warrington, and J. Sturgeon.
2971. A. I. L. Gordon.
2972. G. Axton and J. Leach.
2977. J. D. de Boulimbert.
2982. E. W. Otway.
2985. H. Caunter.
3058. J. Norton.
3095. J. B. Thompson.
3105. J. and J. Leeming and J. Lister.
3180. J. G. Aram.
65. J. Welsh.
468. J. G. Jones.
574. C. J. Falkman.
617. A. Akeroyd.
861. C. J. L. Leffler.

Patents on which the Stamp Duty of £50 has been Paid.

1505. E. J. Bridell.
1551. W. Roberts and T. Greenacre.
1519. M. A. F. Mennons.
1521. W. Naylor.
1543. G. Crawford.
1544. J. Needham.
1639. G. Ermen and R. Smith.

Patents on which the Stamp Duty of £100 has been paid.

1174. F. A. Gatty.
1297. F. A. Gatty.
1244. J. Meiklejon.
1319. J. S. Crosland.

Registered Designs.

Portable Fire Engine—May 10—4710—Merryweather and Son, 63, Long-acre, and York-street, York-road, Lambeth, S.
Rack Pulley—May 15—4711—Messrs. C. and E. Gray, Birmingham.
Cleaning Rod for Small Arms—May 19—4712—Theophilus Murcote, 68, Haymarket.